

CLAIMS

The invention claimed is:

1. A light emitting assembly comprising:

a solid state first light source; and

a second light source,

wherein said first and second light sources oriented such that when said first and

5 second light sources emit light, light projected from said first and second light sources overlaps and is capable of forming effective white light, wherein neither of said first and second light sources projects light having a red hue, and wherein the light projected from said first light source exhibits color coordinates different from the light projected from said second light source.

2. The light emitting assembly according to claim 1, where said first light source emits blue light.

3. The light emitting assembly according to claim 1, where said first light source emits visible light.

4. The light emitting assembly according to claim 1, where said second light source is a photoluminescent source.

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5. The light emitting assembly according to claim 4, where said photoluminescent source is disposed to receive light from said first light source.

6. The light emitting assembly according to claim 1 and further including a leadframe and an encapsulant, where said first light source is a semiconductor optical radiation emitter and is mounted on said leadframe and encapsulated by said encapsulant.

7. The light emitting assembly according to claim 6 wherein said leadframe includes a heat extraction member and a plurality of electrical leads, said heat extraction member providing a thermal path from said semiconductor optical radiation emitter having a lower thermal resistance than a thermal path provided by said electrical leads.

8. The light emitting assembly according to claim 7, where said second light source is a semiconductor optical radiation emitter and is mounted on said leadframe and encapsulated by said encapsulant.

9. The light emitting assembly according to claim 7, where said second light source is a fluorescent dye or phosphor.

10. A light emitting assembly comprising a first solid state light source and a second light source, said light sources oriented such that when said first and second light sources emit

light, light projected from said first and second light sources overlaps and is capable of forming effective white light, wherein said first light source projects light having a blue hue, and wherein said second light source projects light having a hue other than blue.

- 82
11. The light emitting assembly of claim 10, wherein said first light source is an LED.
 12. The light emitting assembly of claim 10, wherein said second light emitting source is a phosphorescent or fluorescent dye or pigment.
 13. The light emitting assembly of claim 10, wherein said phosphorescent or fluorescent dye or pigment being disposed so as to be irradiated with light from said first light source.
 14. The light emitting assembly of claim 10 and further comprising an optical element spaced apart from said first light source, said phosphorescent or fluorescent dye or pigment being disposed on or within said optical element.
 15. The light emitting assembly according to claim 10 and further including a leadframe and an encapsulant, where said first light source is a semiconductor optical radiation emitter and is mounted on said leadframe and encapsulated by said encapsulant.
 16. The light emitting assembly according to claim 15 wherein said leadframe includes a heat extraction member and a plurality of electrical leads, said heat extraction member

providing a thermal path from said semiconductor optical radiation emitter having a lower thermal resistance than a thermal path provided by said electrical leads.

17. The light emitting assembly according to claim 16, where said second light source is a semiconductor optical radiation emitter and is mounted on said leadframe and encapsulated by said encapsulant.

18. The light emitting assembly according to claim 16, where said second light source is a fluorescent dye or phosphor.

19. A light emitting assembly comprising:

an LED emitting light having a first hue; and

an optical element spaced apart from said LED and having a phosphorescent or fluorescent dye or pigment disposed on or within said optical element, said phosphorescent or fluorescent dye or pigment emitting light having a second hue when irradiated with light from said LED, wherein said first and second hues are binary complements of one another such that effective white light is projected from said optical element.

20. The white light emitting device of claim 19, wherein said optical element transmits a portion of the light from said LED.

21. The white light emitting device of claim 19, wherein said first hue is blue.

22. The white light emitting device of claim 19, wherein said optical element is a lens.
23. The white light emitting device of claim 19, wherein said optical element is a diffuser.
24. The white light emitting device of claim 19, wherein said optical element is a lens having a diffusing surface.

25. A white light emitting device comprising:
- a source of radiation having a dominant wavelength equal to or less than about 550 nm;
- and
- an optical element mounted in spaced relation from said radiation source to receive the radiation emitted from said radiation source,
- where said optical element includes a fluorescent dye or phosphor that is responsive to the radiation received from said radiation source to generate and emit light,
- where the light emitted from said device is substantially white light.

26. The white light emitting device of claim 25, wherein said radiation source is an LED.
27. The white light emitting device of claim 26, wherein said LED emits blue light.

28. The white light emitting device of claim 26, wherein said optical element allows some of the light from said LED to pass through and said fluorescent dye or phosphor emits light having a color that is a binary complement of that emitted from said LED.

29. The white light emitting device of claim 25, wherein said fluorescent dye or phosphor includes yttrium aluminum garnet.

30. The white light emitting device of claim 25, wherein said fluorescent dye or phosphor is coated on at least one surface of said optical element.

31. The white light emitting device of claim 25, wherein said fluorescent dye or phosphor is dispersed within said optical element.

32. The white light emitting device of claim 25, wherein said optical element is a lens.

33. The white light emitting device of claim 25, wherein said optical element is a diffuser.

34. The white light emitting device of claim 25, wherein said optical element is a lens having a diffusing surface.

35. A light emitting device comprising:
a leadframe including a plurality of electrical leads and a heat extraction member;

at least one semiconductor optical radiation emitter mounted on said leadframe and electrically coupled to at least two of said electrical leads;

5 an encapsulant covering said semiconductor optical radiation emitter and portions of said electrical leads and said heat extraction member; and

a fluorescent dye or phosphor disposed to receive light from said semiconductor optical radiation emitter and for generating light having a different hue than that projected from said semiconductor optical radiation emitter, wherein said heat extraction
10 member providing a thermal path from said semiconductor optical radiation emitter having a lower thermal resistance than a thermal path provided by said electrical leads.

36. The light emitting device of claim 35, wherein the light generated by said fluorescent dye or phosphor and the light projected from said at least one semiconductor optical radiation emitter overlaps and forms effective white light.

37. The light emitting device of claim 36, wherein said at least one semiconductor optical radiation emitter emits blue light.

38. The light emitting device of claim 35, wherein said at least one semiconductor optical radiation emitter includes a plurality of LED chips at least one of which emits blue light.

39. The light emitting device of claim 35, wherein said at least one semiconductor optical radiation emitter includes a plurality of LED chips and wherein the light projected by the LED chips overlaps and forms blue light.

40. The light emitting device of claim 35, wherein said fluorescent dye or phosphor is disposed on said encapsulant.

41. The light emitting device of claim 35 and further including an optical element spaced apart from said encapsulant, wherein said fluorescent dye or phosphor is disposed on or within said optical element.

42. The light emitting device of claim 35, wherein said fluorescent dye or phosphor includes yttrium aluminum garnet.

43. A method of generating white light comprising the steps of:

providing at least one LED; and

positioning an optical element to receive the radiation from said LED, the optical element having a fluorescent dye or phosphor that responds to the received radiation by

5 emitting light, where the light emitted from the optical element is substantially white light.

44. A light emitting assembly comprising:

a first light source; and

5 a photoluminescent second light source excited by a semiconductor radiation source,
wherein said first and second light sources oriented such that when said first and
second light sources emit light, light projected from said first and second light sources
overlaps and is capable of forming effective white light, wherein the light projected from said
first light source exhibits color coordinates different from the light projected from said second
light source.

45. The light emitting assembly of claim 44, wherein said photoluminescent second light
source is a phosphorescent source.

46. The light emitting assembly of claim 44, wherein said photoluminescent second light
source is a fluorescent source.

47. The light emitting assembly of claim 46, wherein said fluorescent source is a
fluorescent crystal.

48. The light emitting assembly of claim 47, wherein said first light source includes a LED
chip and said fluorescent crystal is disposed a surface of said LED chip.

49. The light emitting assembly of claim 46, wherein said fluorescent source is a
fluorescent dye or pigment.

50. The light emitting assembly of claim 44 and further including an encapsulant disposed over said first light source, said photoluminescent second light source is dispersed within said encapsulant.

51. The light emitting assembly of claim 44 and further including an encapsulant disposed over said first light source, said photoluminescent second light source on said encapsulant.

52. The light emitting assembly of claim 44, wherein said photoluminescent second light source is provided as a glob over said first light source.

53. The light emitting assembly of claim 44, wherein said first light source is photoluminescent.

54. The light emitting assembly of claim 53, wherein said photoluminescent first light source is excited by the same semiconductor radiation emitter that excites said second light source.

55. The light emitting assembly of claim 54, wherein said semiconductor radiation source is an inorganic LED chip.

56. The light emitting assembly of claim 54, wherein said semiconductor radiation source is an OLED.

57. The light emitting assembly of claim 54, wherein said semiconductor radiation source is a LEP.

58. The light emitting assembly of claim 53, wherein at least one of said photoluminescent first and second light sources is a phosphorescent source.

59. The light emitting assembly of claim 53, wherein at least one of said photoluminescent first and second light sources is a fluorescent source.

60. The light emitting assembly of claim 59, wherein said fluorescent source is a fluorescent crystal.

61. The light emitting assembly of claim 59, wherein said fluorescent source is a fluorescent dye or pigment.

62. The light emitting assembly of claim 44, wherein said first light source is a solid state light source.

63. The light emitting assembly of claim 62, wherein said first light source is said semiconductor radiation source, which excites said photoluminescent second light source.

64. The light emitting assembly of claim 62, wherein said first light source includes an inorganic LED chip.

65. The light emitting assembly of claim 62, wherein said first light source includes a LEP.

66. The light emitting assembly of claim 62, wherein said first light source includes a OLED.

67. A light emitting assembly comprising:

a first light source including a LEP; and

a second light source,

wherein said first and second light sources oriented such that when said first and

5 second light sources emit light, light projected from said first and second light sources

overlaps and is capable of forming effective white light, wherein the light projected from said

first light source exhibits color coordinates different from the light projected from said second light source.

68. The light emitting assembly of claim 67, wherein said second light source includes a LEP.

69. A light emitting assembly comprising:

a first light source including an OLED; and

a second light source,

wherein said first and second light sources oriented such that when said first and

5 second light sources emit light, light projected from said first and second light sources overlaps and is capable of forming effective white light, wherein the light projected from said first light source exhibits color coordinates different from the light projected from said second light source.

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70. The light emitting assembly of claim 67, wherein said second light source includes a OLED.

71. A light emitting device comprising first, second, and third light emitting sources oriented such that when said first, second, and third light sources are energized, light emitted from said first, second, and third light sources overlaps and is capable of forming effective white light, wherein the light emitted from said first light source exhibits color coordinates different from the
5 light emitted from said second and third light sources, the light emitted from said second light source exhibits color coordinates different from the light emitted from said third light source, and wherein at least one of said light emitting sources is a photoluminescent source.

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72. The light emitting device of claim 71, wherein at least one of said light emitting sources is an electroluminescent device.

73. The light emitting device of claim 72, wherein said electroluminescent source is an LED.

74. The light emitting device of claim 71, wherein all of said light emitting sources are photoluminescent sources.

75. The light emitting device of claim 74, wherein said photoluminescent sources are fluorescent sources.

76. The light emitting device of claim 75, wherein said fluorescent sources are fluorescent dyes.

77. The light emitting device of claim 75, wherein said fluorescent sources are fluorescent crystals.

78. The light emitting device of claim 75, wherein said fluorescent sources are fluorescent pigments.

79. The light emitting device of claim 74, wherein said photoluminescent sources are phosphor sources.

80. The light emitting device of claim 71, wherein said first and second light emitting sources are photoluminescent sources.

81. The light emitting device of claim 80, wherein said third source is an electroluminescent source.

82. The light emitting device of claim 81, wherein said first and second light sources are excited by light emitted from said third light emitting source.

83. The light emitting device of claim 81, wherein said first and second light sources are excited by light emitted from a semiconductor radiation emitting source.

84. The light emitting device of claim 83, wherein said semiconductor radiation emitting source emits ultraviolet light.

85. The light emitting device of claim 84, wherein said semiconductor radiation emitting source is a LED.

86. The light emitting device of claim 74, wherein said light sources are excited by light emitted from a semiconductor radiation emitting source.

87. The light emitting device of claim 86, wherein said semiconductor radiation emitting source emits ultraviolet light.

88. The light emitting device of claim 87, wherein said semiconductor radiation emitting source is a LED.

89. A light emitting device comprising:

a first electroluminescent light source;

a second electroluminescent light source; and

a photoluminescent light source,

5 wherein said first and second electroluminescent light sources are oriented such that light emitted from said first and second electroluminescent light sources overlaps and is capable of forming effective white light, wherein the light emitted from said first electroluminescent light source exhibits color coordinates different from the light emitted from said second electroluminescent light source, and wherein said photoluminescent light source is oriented such
10 that light projected from said photoluminescent light source overlaps with that emitted from said first and second electroluminescent light sources.

90. The light emitting device of claim 89, wherein said first and second electroluminescent light sources are oriented relative to said photoluminescent light source such that said photoluminescent device is excited by light emitted from at least one of said first and second electroluminescent light sources.

91. The light emitting device of claim 89, wherein said photoluminescent light source is excited by light emitted from a semiconductor radiation emitting source.

92. The light emitting device of claim 89, wherein said electroluminescent light sources are semiconductor light emitting devices.
93. The light emitting device of claim 92, wherein said semiconductor light emitting devices are LED chips.
94. The light emitting device of claim 93, wherein said LED chips are mounted on a leadframe and are encapsulated by an encapsulant.
95. The light emitting device of claim 94, wherein said photoluminescent light source is disposed over said LED chips.
96. The light emitting device of claim 95, wherein photoluminescent light source is dispersed within said encapsulant.
97. The light emitting device of claim 95, wherein photoluminescent light source is dispersed over at least a portion of said encapsulant.
98. The light emitting device of claim 89, wherein photoluminescent light source is dispersed on or within a secondary optical element.

99. A discrete light emitting diode component comprising:

a leadframe;

a polymer matrix enclosure;

an LED chip emitting light having a first hue, said LED chip is disposed on said

5 leadframe and enclosed within said enclosure; and

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a narrow band light emitter carried on said leadframe and emitting light of a hue
different than emissions from said LED chip, said LED chip and said narrow band emitter
disposed such that, when said LED chip and said narrow band emitter emit light, emissions
from said LED chip overlap and mix with emissions from said narrow band emitter to form
10 metameric white light.

100. The discrete light emitting diode component of claim 99, wherein said narrow band
light emitter is an LED chip disposed on said leadframe and enclosed within said enclosure.

101. The discrete light emitting diode component of claim 99, wherein said narrow band
light emitter is a photoluminescent material.

102. The discrete light emitting diode component of claim 99, wherein said narrow band
light emitter is a phosphor.

103. The discrete light emitting diode component of claim 99, wherein said LED chip emits light with a peak wavelength less than 505 nm and said narrow band light emitter emits light with a peak wavelength greater than 505 nm.

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